ELSEVIER

Volume 149, Issues 1–3, 10 June 2004

Journal of
Materials
Processing
Technology

www.elsevier.com/locate/jmatprotec

Contents

14th International Symposium on Electromachining ISEM XIV

Preface 1

Keynote Papers

Laser beam machining (LBM), state of the art and new opportunities 2
J. Meijer

EDM and ECM for mass production Philips DAP 18
H.S.J. Altena

1. Abrasive/Water Jet Machining (A/WJM)

Parametric study of magnetic abrasive finishing process 22
D.K. Singh, V.K. Jain, V. Raghuram

Initial research on the ultra-high pressure waterjet up to 700 MPa 30
T. Susuzlu, A.M. Hoogstrate, B. Karpuschewski

Micromachining with abrasive waterjets 37
D.S. Miller

Erosion behaviour and pattern transfer accuracy of protecting masks for micro-abrasive blasting 43
M. Achtsnick, J. Drabbe, A.M. Hoogstrate, B. Karpuschewski

Micro-EDM—recent developments and research issues 50
D.T. Pham, S.S. Dimov, S. Bigot, A. Ivanov, K. Popov

2. Electrical Discharge Machining (EDM)

Influence of selected groups of additives on breakdown in EDM sinking. 58
W. Rehbein, H.-P. Schulze, K. Mecke, G. Wollenberg, M. Storr

Study on the surface modification system with electrical discharge machine in the practical usage. 65
T. Moro, N. Mohri, H. Otsubo, A. Goto, N. Saito

Knowledge based design of EDM electrodes for mould cavities pre-machined by high-speed milling 71
K.R. Mahajan, G.E. Knoppers, J.A.J. Oosterling, C.A. van Luttervelt

The energy aspect of material property in WEDM and its application. 77
Y.S. Liao, Y.P. Yu

The study of high efficiency and intelligent optimization system in EDM sinking process. 83
C. Fenggou, Y. Dayong

The study of EDM hole-drilling method for measuring residual stress in SKD11 tool steel 88
H.-T. Lee, W.P. Rehbach, F.-C. Hsu, T.-Y. Tai, E. Hsu

The publisher encourages the submission of articles in electronic form thus saving time and avoiding rekeying errors. A leaflet describing our requirements is available from the publisher upon request.

CONTENTS direct

This journal is part of **ContentsDirect**, the ***free*** alerting service which sends tables of contents by e-mail for Elsevier books and journals. You can register for **ContentsDirect** online at: **http://contentsdirect.elsevier.com**

Elsevier B.V.

Dynamic optimization of first-order systems via static parametric programming: application to electrical discharge machining . . . 94
P. Huguenin, B. Srinivasan, F. Altpeter, R. Longchamp

Development of a prototype Micro-Wire-EDM machine . . . 99
M.-T. Yan, C.-W. Huang, C.-C. Fang, C.-X. Chang

Neural network modelling and parameters optimization of increased explosive electrical discharge grinding (IEEDG) process for large area polycrystalline diamond . . . 106
F. Cao, Q. Zhang

Development of micro-EDM-center with rapidly sharpened electrode . . . 112
H. Takezawa, H. Hamamatsu, N. Mohri, N. Saito

Removal analysis of WEDM's tapering process and its application to generation of precise conjugate surface . . . 117
A.W.-J. Hsue, H.-C. Su

Machining phenomena in WEDM of insulating ceramics . . . 124
T. Tani, Y. Fukuzawa, N. Mohri, N. Saito, M. Okada

Entrance mark control on precision WEDM . . . 129
T. Sato, J. Shibata

EDM of micro-rods by self-drilled holes . . . 134
M. Yamazaki, T. Suzuki, N. Mori, M. Kunieda

Sensing and compensation of tool wear in milling EDM . . . 139
P. Bleys, J.-P. Kruth, B. Lauwers

Relevant topics in wire electrical discharge machining control . . . 147
F. Altpeter, R. Perez

Performance of two graphite electrode qualities in EDM of seal slots in a jet engine turbine vane . . . 152
K.L. Aas

Creation of long curved hole by means of electrical discharge machining using an in-pipe movable mechanism . . . 157
T. Ishida, S. Kogure, Y. Miyake, Y. Takeuchi

A study to achieve a fine surface finish in Wire-EDM . . . 165
Y.S. Liao, J.T. Huang, Y.H. Chen

Series–parallel resonant converter for an EDM power supply . . . 172
R. Casanueva, F.J. Azcondo, S. Bracho

Improved cemented carbide properties after wire-EDM by pulse shaping . . . 178
H. Juhr, H.-P. Schulze, G. Wollenberg, K. Künanz

Optical emission spectroscopy of electrical discharge machining plasma . . . 184
A. Descoeudres, C. Hollenstein, R. Demellayer, G. Wälder

The effects of powder suspended dielectrics on the thermal influenced zone by electrodischarge machining with small discharge energies . . . 191
F. Klocke, D. Lung, G. Antonoglou, D. Thomaidis

Theoretical modeling of energy balance in electroerosion . . . 198
R. Perez, H. Rojas, G. Walder, R. Flükiger

Improvement in machining performance of die-sinking EDM by using self-adjusting fuzzy control . . . 204
T. Kaneko, T. Onodera

Measurement of impulsive forces and crater formation in impulse discharge . . . 212
T. Tamura, Y. Kobayashi

Unified failure analysis for tubular hydroforming . . . 217
M. Brunet, S. Boumaiza, G. Nefussi

Time-resolved observation of electrode shape of a thin electrode in high-current, single discharge . . . 226
R. Tanabe, Y. Ito, H. Takezawa, N. Mohri

Technology development for EDM using statistical analysis of arcing information . . . 232
J. Ginzel, A. Behrens, J.-P. Wulfsberg

Characterisation of aqueous ferric chloride etchants used in industrial photochemical machining . . . 238
D.M. Allen, H.J.A. Almond

New applications for micro-EDM . . . 246
J. Fleischer, T. Masuzawa, J. Schmidt, M. Knoll

Study on EDM phenomena with in-process measurement of gap distance . . . 250
S. Hayakawa, M. Takahashi, F. Itoigawa, T. Nakamura

On-line selection of rough machining parameters 256
J. Valentinčič, M. Junkar

Micro- and nanoelectric-discharge machining 263
I. Beltrami, C. Joseph, R. Clavel, J.-P. Bacher, S. Bottinelli

Machining of low electrical conductive materials by wire electrical discharge machining (WEDM) 266
J. Kozak, K.P. Rajurkar, N. Chandarana

Some investigations into the electric discharge machining of hardened tool steel using different electrode materials. 272
S. Singh, S. Maheshwari, P.C. Pandey

Molds surface finishing with new EDM process in air with thermoplastic composite electrodes 278
A. Curodeau, M. Richard, L. Frohn-Villeneuve

Clarifying mechanism of determining tool electrode wear ratio in EDM using spectroscopic measurement of vapor density 284
M. Kunieda, T. Kobayashi

Microstructure at submicron scale of the white layer produced by EDM technique 289
G. Cusanelli, A. Hessler-Wyser, F. Bobard, R. Demellayer, R. Perez, R. Flükiger

Micro-EDM drilling of tapered holes for industrial applications 296
C. Diver, J. Atkinson, H.J. Helml, L. Li

An index to evaluate the wear resistance of the electrode in micro-EDM. 304
Y.-Y. Tsai, T. Masuzawa

Threshold technology and its application for gap status detection 310
A.W. Behrens, J. Ginzel, F.-L. Bruhns

Comparison of measured and simulated crater morphology for EDM 316
H.-P. Schulze, R. Herms, H. Juhr, W. Schaetzing, G. Wollenberg

Analysis of motion laws of machining non-sphere by EDM with rotary electrode 323
R. Fujun, H. Dechen, W. Dianjun

Local actuator module for highly accurate micro-EDM 328
Y. Imai, T. Nakagawa, H. Miyake, H. Hidai, H. Tokura

Electrical discharge surface alloying 334
H.G. Lee, J. Simao, D.K. Aspinwall, R.C. Dewes, W. Voice

A review on the use of environmentally-friendly dielectric fluids in electrical discharge machining 341
F.N. Leão, I.R. Pashby

Investigation of material removal mechanisms in EDM of composite ceramic materials 347
B. Lauwers, J.P. Kruth, W. Liu, W. Eeraerts, B. Schacht, P. Bleys

Dry electrical discharge machining of cemented carbide 353
Z. Yu, T. Jun, K. Masanori

Molecular dynamics analysis of self-sharpening phenomenon of thin electrode in single discharge. 358
S. Shimada, H. Tanaka, N. Mohri, H. Takezawa, Y. Ito, R. Tanabe

Study of electrochemical discharge machining technology for slicing non-conductive brittle materials 363
W.Y. Peng, Y.S. Liao

Fundamental study on corrosion of cemented carbide during wire EDM 370
H. Obara, H. Satou, M. Hatano

After 60 years of EDM the discharge process remains still disputed 376
B.M. Schumacher

3. Electrochemical Machining (ECM)

New Approach to enhance the accuracy of ECM. High-precision Short Pulses ECM (HSPECM) 382
J.Y. Wang, A. De Silva, Y. Yanqing, H. Guang jun

Generic aspects of tool design for electrochemical machining 384
J.A. Westley, J. Atkinson, A. Duffield

Electrical discharge machining properties of noble crystals 393
Y. Fukuzawa, N. Mohri, T. Tani, A. Muttamara

Simulation of non-stationary processes of electrochemical machining 398
V.P. Zhitnikov, G.I. Fedorova, O.V. Zinatullina, A.V. Kamashev

A new etchant for the chemical machining of St304 404
A. Fadaei Tehrani, E. Imanian

The mechanism of improving machining accuracy of ECM by magnetic field 409
Z. Fan, T. Wang, L. Zhong

Wear of cathode in abrasive electrochemical grinding of hardly machined materials 414
S. Zaborski, M. Łupak, D. Poroś

Precise pulse electrochemical machining by bipolar current. Aspects of effective technological application 419
A. Zaytsev, I. Agafonov, N. Gimaev, R. Moukhoutdinov, A. Belogorsky

Selected problems of micro-electrochemical machining 426
J. Kozak, K.P. Rajurkar, Y. Makkar

Towards higher accuracy for ECM hybridized with low-frequency vibrations using the response surface methodology 432
S.J. Ebeid, M.S. Hewidy, T.A. El-Taweel, A.H. Youssef

Formation mechanism and elimination of the workpiece surface macro-defects, aligned along the electrolyte stream at electrochemical machining 439
A.N. Zaytsev, V.P. Zhitnikov, T.V. Kosarev

Electrochemical deep hole drilling in super alloy for turbine application 445
D.S. Bilgi, V.K. Jain, R. Shekhar, S. Mehrotra

Development of an electromachining method for machining curved holes 453
M. Uchiyama, T. Shibazaki

Cost of photochemical machining 460
R. Roy, D. Allen, O. Zamora

Modeling of multistage electrochemical shaping 466
V.M. Volgin, A.D. Davydov

3D electrochemical machining computer simulations 472
M. Purcar, L. Bortels, B. Van den Bossche, J. Deconinck

Estimation of the process localization at the electrochemical machining by microsecond pulses of bipolar current 479
T.R. Idrisov, A.N. Zaitzev, V.P. Zhitnikov

A user-friendly simulation software tool for 3D ECM 486
L. Bortels, M. Purcar, B. Van den Bossche, J. Deconinck

Electro-chemical mechanical polishing of copper and chemical mechanical polishing of glass 493
V.C. Venkatesh, S. Izman, S.C. Mahadevan

An intelligent pulse classification system for electro-chemical discharge machining (ECDM)—a preliminary study 499
T.K.K.R. Mediliyegedara, A.K.M. De Silva, D.K. Harrison, J.A. McGeough

Theory of overpotentials in electrochemical micromachining 504
H. Rasmussen, J.A. McGeough

4. Electromachining in Medicine

High efficient surface finishing of bio-titanium alloy by large-area electron beam irradiation 506
A. Okada, Y. Uno, N. Yabushita, K. Uemura, P. Raharjo

5. Hybrid Processes

Modelling the aspects of precision and efficiency in laser-assisted jet electrochemical machining (LAJECM) 512
P.T. Pajak, A.K.M. De Silva, J.A. McGeough, D.K. Harrison

Structure of process energy sources for time-parallel combined processes 519
M. Läuter, H.-J. Trautmann, M. Zybura-Skrabalak, H.-P. Schulze, G. Wollenberg

Optimisation of grit protrusion in the electro-discharge dressing process of large grit size CBN grinding wheels 524
N. Ortega, J.A. Sánchez, J. Aranceta, J.A. Marañón, X. Maidagan

Building of rules base for fuzzy-logic control of the ECDM process 530
G. Skrabalak, M. Zybura-Skrabalak, A. Ruszaj

6. Laser Beam Machining (LBM)

Laser-induced liquid-phase jet-chemical etching of metals 536
A. Stephen, G. Sepold, S. Metev, F. Vollertsen

High-power impulse YAG laser system for cutting, welding and perforating of super hard materials 541
S.V. Usov, I.V. Minaev

Ti6Al4V sheets lap and butt joints carried out by CO_2 laser: mechanical and morphological characterization 546
F. Caiazzo, F. Curcio, G. Daurelio, F. Memola Capece Minutolo

Systemized approach in laser industrial systems design 553
V. Kovalenko, R. Zhuk

Experimental evaluation of laser cutting of bone 557
R.J. Wallace, C.J. Whitters, J.A. McGeough, A. Muir

7. Micro and Nano Machining by Non-traditional Methods

Excimer laser micromachining for 3D microstructure 561
K.H. Choi, J. Meijer, T. Masuzawa, D.-H. Kim

Micro-fabrication of crystalline silicon by controlled alkali etching 567
Y. Fulong, G. Yongfeng, L. Yingchun, Y. Yongda, F. Honggang, C. Kai, L. Xichun

A CAD/CAM system for micro-ED-milling of small 3D freeform cavity. 573
W. Zhao, Y. Yang, Z. Wang, Y. Zhang

Using ultra thin electrodes to produce micro-parts with wire-EDM. 579
F. Klocke, D. Lung, D. Thomaidis, G. Antonoglou

Nano and microscale surface and sub-surface modifications induced in optical materials by femtosecond laser machining 585
A. Malshe, D. Deshpande

8. Other non-traditional machining methods:- EBM, IBM, CHM, PCM

Investigation of pre-dressing time for ELID grinding technique 591
R. Pavel, M. Pavel, I. Marinescu

Multi-spherical probe machining by EDM. Combining WEDG technology with one-pulse electro-discharge 597
D.-Y. Sheu

9. Rapid Manufacturing

Feasibility study on developing productivity and quality improved layered manufacturing method for rapid prototyping/tooling/manufacture 604
A.K. Egodawatta, D.K. Harrison, A. De Silva, G. Haritos

Laser sintering (SLS) of hard metal powders for abrasion resistant coatings 609
K. Maeda, T.H.C. Childs

10. Rapid Prototyping

Selective laser melting of iron-based powder 616
J.P. Kruth, L. Froyen, J. Van Vaerenbergh, P. Mercelis, M. Rombouts, B. Lauwers

Combination of Yb:YAG-disc laser and roll-based powder deposition for the micro-laser sintering. 623
H. Haferkamp, A. Ostendorf, H. Becker, S. Czerner, P. Stippler

Machining of electrically conductive CVD diamond tool blanks using EDM 627
R.H. Olsen, R.C. Dewes, D.K. Aspinwall

11. Ultrasonic Machining (USM)

Ultrasonic application in drilling. 633
R. Neugebauer, A. Stoll

Study on technology of ultrasonic vibration aided electrical discharge machining in gas 640
Q.H. Zhang, J.H. Zhang, S.F. Ren, J.X. Deng, X. Ai

Author Index 645
Subject Index 647